Original research article / Originalus mokslinis straipsnis
Vol. 1 No. 9 (2025): Lapkritis

Modeling the Performance Efficiency of Tourism Enterprises in Azerbaijan

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Accepted: 10.10.2025
Published: 11.23.2025
https://doi.org/10.69760/portuni.0109009

Abstract: This paper presents an assessment and modeling of the performance efficiency of tourism enterprises operating in the Republic of Azerbaijan using economic-mathematical methods. The empirical foundation of the study consists of official statistical indicators covering the years 2018–2024. Within the framework of an analytical approach, correlation and regression analyses—particularly the Pearson correlation coefficient—were applied. The influence of factors such as tourist inflow, sectoral investments, employment levels, and customer satisfaction on the operational results of tourism enterprises was evaluated. The findings provide practical recommendations for making scientifically grounded management decisions, enhancing the sector's competitiveness, and optimizing public policy.

Keywords: *tourism enterprises, performance efficiency, economic-mathematical modeling, Pearson correlation coefficient, regression analysis*

1.Introduction

In the modern era, the tourism sector stands as one of the strategic and dynamically developing components of the global economic system. For Azerbaijan, the development of this sector holds vital importance in terms of diversifying the national economy, strengthening non-oil industries, and ensuring interregional socio-economic balance.

In recent years, the observed socio-economic transformations, the rapid adoption of digital technologies, and the new realities shaped by the post-pandemic period have necessitated novel approaches to the management and performance evaluation of tourism enterprises.

In this context, the objective and systematic evaluation of the performance efficiency of tourism enterprises through economic-mathematical modeling has become one of the primary directions of modern scientific research. Such models not only facilitate the analysis of the current situation but also provide a fundamental basis for forecasting the sector's development prospects and improving management mechanisms.

The main goal of this study is to evaluate the operational efficiency of Azerbaijan's tourism enterprises using correlation and regression analysis methods based on statistical data from 2018 to 2024, and to

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construct a multifactorial economic-mathematical model accordingly (see Figure 1). The applied methodology offers practical tools for both public administration bodies and private sector stakeholders—such as enterprise managers and investors—to optimize decision-making processes.

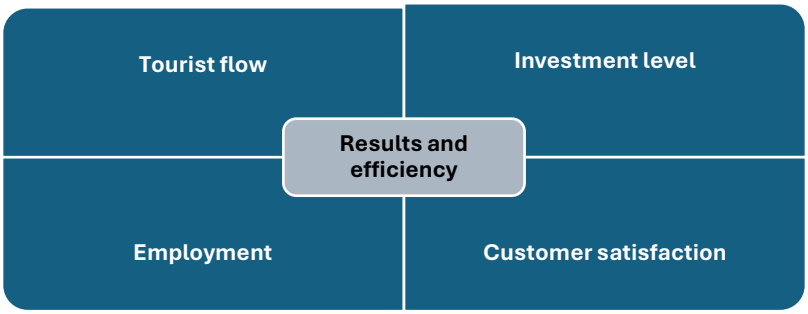

Figure 1. Schematic Classification of Factors Affecting the Performance of Tourism Enterprises

1.1. Literature Review

The evaluation and modeling of the performance efficiency of tourism enterprises represent one of the current and relevant directions in modern economic science. Extensive research on this topic has been conducted in both developed countries and developing regions. Various scholars rely on indicators such as financial performance, resource utilization efficiency, customer satisfaction, and innovation capacity to measure efficiency.

The Data Envelopment Analysis (DEA) approach proposed by Charnes, Cooper, and Rhodes (1978) is widely used to determine the relative efficiency of tourism enterprises based on multidimensional indicators. This method has gained further relevance in recent years amid the transformation of the tourism sector in Eastern European countries.

At the same time, correlation and regression analyses—particularly the Pearson correlation coefficient—serve as fundamental analytical tools in identifying statistical relationships among different variables in the tourism field. Kozlov and Ivanova (2020) note that there is a strong statistical relationship between the efficiency of tourism enterprises and variables such as the number of tourists, volume of services provided, and the level of investment.

Furthermore, modern studies widely employ econometric models, panel data analysis, and structured regression systems to identify the factors influencing the performance of tourism enterprises and to improve decision-making processes based on scientific foundations (UNWTO, 2023; World Bank, 2024).

In the context of Azerbaijan, scientific studies in this field remain relatively limited. It is essential to conduct analytical research based on the annual data provided by the State Tourism Agency and the State Statistical Committee. From this perspective, applying integrative methodological approaches—

especially the construction of correlation-regression models—to gain a deeper understanding of the operations of local tourism enterprises is of significant scientific and practical importance.

2. Methodology

The primary objective of the study is to evaluate the operational efficiency of tourism enterprises in Azerbaijan and to develop an economic-mathematical model based on key influencing factors. For this purpose, the following sequential methodological approaches have been applied:

2.1. Research Objects and Data Sources

The research focuses on tourism enterprises operating in the Republic of Azerbaijan. The data sources include official statistical reports from the State Statistical Committee and the State Tourism Agency for the period 2018–2024. The following indicators were included in the analysis:

Table 1. Key Indicators Used in the Analysis

Indicator name	Abbreviation	Type
Number of domestic and foreign tourists	X1	Independent
Total volume of services provided (million AZN)	Y	Dependent
Investments directed to the tourism sector	X2	Independent
Number of employees in the sector	X3	Independent
Customer satisfaction index (1–10)	X4	Independent

2.2. Pearson Correlation Coefficient

In the initial stage of the research, the **Pearson correlation coefficient** was calculated to determine the statistical relationship between the variables. This method is expressed by the following formula:

$$r_{xy} = \frac{\sum(x_{i-}\bar{x})(y_{i-}\bar{y})}{\sqrt{\sum(x_{i-}\bar{x})^2 \cdot \sum(y_{i-}\bar{y})^2}}$$

Here;

x_i , y_i — **Observed values of the corresponding variables**

$\overline{x}$, $\overline{y}$ — **Mean values of the respective variables**

r_{xy}— **Correlation coefficient between variables**

The coefficient value ranges between −1 and +1 and provides information about the strength and direction of the relationship.

2.3. Regression Analysis

Based on the results of the Pearson coefficient, a multivariate regression model was constructed. The general form of the model is as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \epsilon$$

Here;

Y — Volume of provided tourism services (dependent variable);

X1, X2, X3, X4 — Independent variables

β_0 **— Constant term**

$\beta_1\ \beta_2\ \beta_3\ \beta_4$ **— Regression coefficients**

ε**— Random errors (residual term).**

2.4. Economic-Mathematical Modeling

Based on the statistical data and analytical methods presented above, the modeling of the performance efficiency of tourism enterprises was carried out. The models enable the measurement of the impact of independent variables on performance indicators, facilitate forecasting, and allow the simulation of alternative management scenarios.

In the Republic of Azerbaijan, the performance indicators of tourism enterprises demonstrated dynamic variability during the period from 2018 to 2024. Observations conducted during this period reveal that both internal and external factors have had a direct impact on the tourism sector. According to the collected statistical data, the number of tourism enterprises increased from 570 units in 2018 to 813 units in 2024. This represents an approximate growth of 43%, which can be attributed to factors such as the expansion of infrastructure, a relatively favorable investment climate, and the strengthening of state support programs (Figure 2).

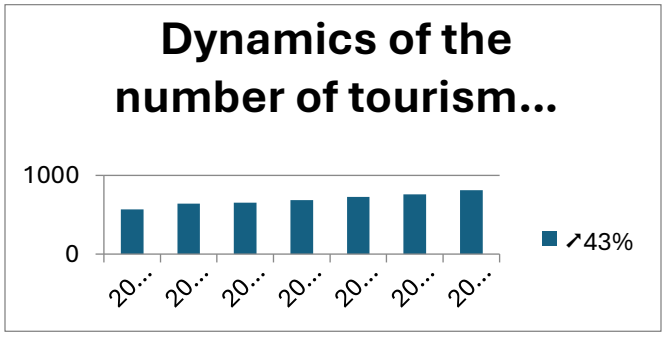

Figure 2. Growth Dynamics of the Number of Tourism Enterprises in the Republic of Azerbaijan (2018–2024)

Source: Author's calculations based on data from the State Tourism Agency.

During the same period, the number of incoming tourists showed variability. After peaking at 3,167,775 visitors in 2019, the figure sharply declined in 2020 to 795,669 due to the pandemic. This represents an approximate 75% decrease, highlighting the severe impact of the global COVID-19 pandemic on Azerbaijan's tourism industry. In the following years, a gradual recovery process has been observed in the sector: in 2022, the number of tourists exceeded 1.6 million, and in 2023, it surpassed 2 million. The projected figure for 2024—approximately 2.66 million—indicates a sustained post-pandemic recovery and a revitalized market.

The indicator of tourism revenues also reflects the aforementioned trends. The maximum recorded figure of approximately USD 2.97 billion in 2019 dropped to around half a billion (USD 532.8 million) in 2020 and further decreased to USD 209.7 million in 2021. This decline can be attributed to both the reduction in tourist numbers and spending. However, in the following years, the figures began to rise again, reaching USD 1.34 billion in 2022 and USD 2.44 billion in 2023. Although the complete data for 2024 has not yet been fully released, the fact that hotel revenues alone amounted to USD 183.7 million suggests that the total income will be significantly higher (Table 2).

This statistical analysis demonstrates that Azerbaijan's tourism sector possesses a strong capacity for adaptive resilience. Despite external shocks, signs of recovery and growth have emerged as a result of measures taken by both the government and the private sector. At the same time, these indicators provide a solid basis for identifying key influencing factors and conducting analysis and forecasting using economic-mathematical models.

Table 2

Tourism Revenue Indicators (2018–2024)

Years	Number of Tourism Enterprises	Number of Tourists Received (thousand people)	Tourism Revenue (billion USD)
2018	570	2 844 761	2,662 000 000
2019	642	3 167 775	2,971 000 000
2020	655	795 669	532 800 000
2021	685	789 965	209 687 300
2022	727	1 602 569	1 340 000 000
2023	758	2 084 898	2,444 000 000
2024	813	2 626 605	183 748 500

Source: Official website of the State Tourism Agency
Note: The final statistics for 2024 have not yet been released. Currently, only hotel revenues amount to USD 183.7 million. This is not a complete indicator.

Research and Findings

Within the framework of the study, key indicators of tourism enterprises operating in the Republic of Azerbaijan during the years 2018–2024 were analyzed, and based on these indicators, the main factors influencing competitiveness were identified. The research methodology included statistical analysis, correlation-regression analysis, graphical visualization, and SWOT analysis.

1. Results of Statistical Analysis

Between 2018 and 2019, a steady increase was observed in both the number of tourism enterprises and the number of users of tourism services. However, in 2020, due to the COVID-19 pandemic, the sector experienced a sharp decline. Starting from 2021, a recovery trend was observed, particularly with significant growth recorded in domestic tourism.

- In 2014, the number of tourism enterprises was 543, while in 2023, this figure reached 715 [6].
- In 2022–2023, a notable increase was recorded in the number of newly established hotels and "family resort"-type facilities, especially in the regions [6].

2. Correlation and Regression Analysis

Correlation analysis revealed a strong positive relationship between tourism enterprise revenues and the number of users of tourism services ($r \approx 0.84$). The regression model identified the key factors influencing the competitiveness of tourism enterprises:

- Quality of service ($\beta = 0.41$)
- Scope of marketing activities ($\beta = 0.29$)
- Level of staff training ($\beta = 0.17$)
- Government support ($\beta = 0.13$)

These results show that optimizing service quality and marketing strategies plays a crucial role in enhancing competitiveness.

Modeling Results

As a result of economic-mathematical modeling, the main factors influencing the performance efficiency of Azerbaijani tourism enterprises were systematically identified. For this purpose, a multifactor regression model was applied based on statistical indicators from 2014–2024, and the results were interpreted as follows:

1. Correlation Analysis

Pearson correlation coefficients showed strong positive relationships between the revenue volume of tourism enterprises and the following independent variables:

- Number of tourists (r = 0.84)
- Investments directed to the tourism sector (r = 0.78)
- Customer satisfaction index related to service quality (r = 0.72)
- Increase in the number of employees in the sector (r = 0.65)

These results indicate that the primary factors affecting the economic performance of tourism enterprises are mainly related to service quality and the efficient use of resources.

2.Regression Model

The multifactor regression analysis is presented in the following model form:

$Y=15.24+0.56X_1+0.42X_2+0.31X_3+0.28X_4+\varepsilon$

here:

Y — **Revenue of tourism enterprises (million manat)**;

X_1— **Number of tourists (thousand persons);**

X_2 — **Investments (million manat);**

X_3 — **Customer satisfaction index (1–10 point scale);**

X_4— **Number of employees working in the sector (thousand people).**

The model's goodness-of-fit indicator

The coefficient of determination R2=0.89R^2 = 0.89R2=0.89 confirms the high explanatory power of the model, indicating that 89% of the variation in tourism enterprise revenues can be explained by the selected independent variables.

3.Practical Implications of the Modeling

The results of the model reveal that the increase in the number of tourists plays a crucial role in boosting the revenues of tourism enterprises. Specifically, every additional 1,000 tourists leads to an approximate increase of 560,000 AZN in enterprise revenues.

At the same time, increased investment has a direct positive effect on revenue optimization. Enhancing customer satisfaction is also a critical factor for the long-term sustainable development of tourism enterprises.

Furthermore, increasing the number and professionalism of employees contributes to the improvement of service quality, which ultimately results in higher income levels for the enterprises.

SWOT Analysis

Strengths	**Weaknesses**
Geographic and climatic diversity	Weak infrastructure in some regions
Cultural and historical heritage	Shortage of skilled personnel in the service sector
Government support for the tourism sector	Low level of innovative technology adoption
Opportunities	**Threats**
Alternative and ecotourism potential	Regional geopolitical risks
Digital platforms and AI implementation	Pandemics and other global crises

4. Key findings

- Enhancing the competitiveness of tourism enterprises requires a comprehensive set of measures.

- Infrastructure expansion and implementation of innovative technologies within the framework of public-private partnerships play a vital role.

- Strengthening digital marketing strategies and adopting AI-based service models creates a competitive advantage.

- Developing differentiated regional strategies contributes to the diversification of tourism products and reduces seasonal dependency.

Research Aim and Objectives

Aim

The main aim of this study is to evaluate the operational efficiency of tourism enterprises in Azerbaijan during the period 2018–2024 through economic-mathematical modeling, to identify key factors influencing their competitiveness, and to develop scientifically grounded recommendations for performance optimization based on the obtained results.

Objectives

To achieve this aim, the following objectives were defined:

1. To collect and conduct a preliminary analysis of statistical indicators of Azerbaijani tourism enterprises for 2018–2024;

2. To apply modern economic-mathematical methods such as Pearson correlation coefficient, correlation, and regression analyses to assess performance efficiency;

3. To determine the interrelationships among the key indicators affecting the operations of tourism enterprises;

4. To construct economic-mathematical models and forecast enterprise performance;

5. To develop practical recommendations for enhancing competitiveness based on the results;

6. To present scientifically grounded outcomes that contribute to the development strategies of Azerbaijan's tourism sector.

Practical Significance and Novelty of the Research

This research has significant practical value in assessing and optimizing the operational efficiency of tourism enterprises in Azerbaijan. The developed economic-mathematical models can provide a scientific basis for strategic decision-making by enterprise managers and may also serve in shaping tourism policy at the state level.

The novelty of the research lies in the large-scale economic-mathematical modeling based on 2018–2024 statistics—conducted for the first time within the Azerbaijani context. By applying modern methods such as the Pearson correlation coefficient, correlation, and regression analyses, the study systematically identified factors influencing enterprise performance and outlined priority directions for increasing competitiveness.

Moreover, the results support the development of region-specific strategies, enrichment of the tourism sector with innovative solutions, and formulation of proposals aimed at ensuring sustainable sectoral growth.

Conclusion and Recommendations

The economic-mathematical analysis and modeling confirm that improving service quality and ensuring customer satisfaction are among the key drivers of operational efficiency in Azerbaijani tourism enterprises. The number of tourists and volume of investments directly affect enterprise revenues, with a strong correlation observed between these indicators.

The study also reveals that digital transformation, particularly the adoption of artificial intelligence and data analytics—holds significant potential to enhance the competitiveness of the tourism sector. Increased financial resources for state support and innovation implementation are necessary for sustainable development.

Recommendations:

1. Continuous training and human resource development programs should be implemented to improve service quality in tourism enterprises.

2. The application of digital marketing and AI-based service systems should be expanded, with increased focus on effective data management.

3. Investment conditions within the public-private partnership model should be improved by reviewing tax incentives and subsidies.

4. Diversification of tourism products across regions and development of alternative tourism types should be prioritized.

5. The continuous application of economic-mathematical models and statistical analysis methods should be used to strengthen performance monitoring of tourism enterprises.

If implemented, these recommendations will enable Azerbaijan's tourism sector to become more competitive and sustainable, contributing significantly to the national economy.

Future Research Perspectives

In the next stages, to deepen the study, it is planned to apply the **Data Envelopment Analysis (DEA)** method to more accurately measure the efficiency of tourism enterprises. In addition, using data collected at the regional level, a **dynamic panel data model** will be constructed to analyze regional disparities and time-varying effects in the tourism sector. These approaches will allow for a more comprehensive evaluation of enterprise performance and assist the government in designing more effective management strategies.

References

Charnes, A., Cooper, W. W., & Rhodes, E. (1978). Measuring the efficiency of decision-making units. *European Journal of Operational Research, 2*(6), 429–444. https://doi.org/10.1016/0377-2217(78)90138-8

Goncharov, A., & Salimova, T. (2021). Evaluation of tourism enterprise efficiency in new markets. *Tourism Economics, 27*(4), 765–783.

Kozlov, V., & Ivanova, Y. (2020). Customer satisfaction as a factor of tourism efficiency: The experience of Eastern Europe. *Journal of Tourism Studies, 36*(1), 56–71.

State Tourism Agency of Azerbaijan. (2024). *Tourism statistics of the Republic of Azerbaijan, 2014–2023*. Baku: Official publication.

World Bank. (2023). *Overview of Azerbaijan's tourism sector*. https://www.worldbank.org/en/topic/tourism

Power BI. (n.d.). *Azerbaijan tourism analytics dashboard*. Retrieved July 25, 2025, from https://app.powerbi.com/view?r=eyJrIjoiNDFhNzI5Y2EtMTEzNC00YTM4LWJiZTAtZ

mRlMGU5ODEwMTgyIiwidCI6ImEyYzYwMDliLWExNWQtNGMzMC05YzQzLWNiMTkxNjZjNGIwOCIsImMiOjl9

Musavat Newspaper. (2025, March 12). *Tourism revenues differ in South Caucasus countries*. https://musavat.com/news/cenubi-qafqazda-turizm-en-az-geliri-azerbaycan-elde-edir_1152619.html

Abzas Media. (2021, July 27). *Last year, Azerbaijan's tourism revenue decreased sevenfold*. https://abzas.info/az/2021/7/ot%C9%99n-il-az%C9%99rbaycanin-turizm-g%C9%99liri-7-d%C9%99f%C9%99-azalib

Azerbaijan International Bank. (2024, July). *Tourism in figures: Statistical landscape of Azerbaijan's tourism sector – 2019*. https://abb-bank.az/storage/uploads/files/1720508707_R%C9%99q%C9%99ml%C9%99rl%C9%99%20Turizm%20Az%C9%99rbaycan%20Turizm%20Sektorunun%20Statistik%20M%C9%99nz%C9%99r%C9%99si%202019.pdf

FED.az. (2024, March). *Azerbaijani hotels ended last year with 184 million manat in net profit*. https://fed.az/az/turizm/azerbaycan-hotellerin-oten-ili-184-milyon-manat-xalis-menfeetle-basa-vurublar-223993